

DERWENT-ACC-NO: 1997-493799

DERWENT-WEEK: 200271

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TITLE: Colour filter for e.g. colour liquid display device, plasma display panel of STN system - has filter layer whose surface is planarised after sanding overlapping portions, formed through patterning process, of RGB films that are sequentially arranged between shading layers of transparent substrate

PATENT-ASSIGNEE: TOPPAN PRINTING CO LTD[TOPP]

PRIORITY-DATA: 1996JP-0031879 (February 20, 1996)

PATENT-FAMILY:

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APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP 09230124A	N/A	1996JP-0031879	February 20, 1996

INT-CL (IPC): G02B005/20, G02F001/1335

RELATED-ACC-NO: 2002-651518

ABSTRACTED-PUB-NO: JP 09230124A

BASIC-ABSTRACT:

The colour filter has a transparent substrate (1) on which the pattern-shaped shading layers (2) are formed. A filter layer (3) is formed by sequentially arranging the RGB films (3B,3R,3G) on the openings by which the shading layers are not formed.

A patterning process is performed so that peripheries of two adjacent colour films will overlap. Rough sections on filter surface are planarised through sanding.

ADVANTAGE - Planar colour filter is produced without performing e.g. overcoating. Ensures connection among colour films through patterning process. Ensures satisfactory image display by planarising colour filter surface.

CHOSEN-DRAWING: Dwg.2/10

TITLE-TERMS: COLOUR FILTER COLOUR LIQUID DISPLAY DEVICE PLASMA DISPLAY PANEL SYSTEM FILTER LAYER SURFACE PLANE AFTER SAND OVERLAP PORTION FORMING THROUGH PATTERN PROCESS RGB FILM SEQUENCE ARRANGE SHADE

PAT-NO: JP409230124A

DOCUMENT-IDENTIFIER: JP 09230124 A

TITLE: COLOR FILTER

PUBN-DATE: September 5, 1997

INVENTOR-INFORMATION:

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COUNTRY

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N/A

APPL-NO: JP08031879

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ABSTRACT:

PROBLEM TO BE SOLVED: To relieve positional accuracy and to make it possible to form color filters having fine patterns by patterning the peripheral parts of adjacent filter layers so as to overlap these parts on each other with light shielding layers and flattening the build-ups of the overlap parts by polishing.

SOLUTION: Black matrices 2 which are the light shielding layers are pattern formed on a substrate 1 and, thereafter, the filter layer 3R of the first color is pattern formed. Next, the filter layer 3G is patterned in such a manner that the pixel ends thereof overlap on the pixel ends of the filter layer 3R. Similarly, the filter layer 3B is patterned as well. The overlap parts 3A are thereafter removed by the polishing treatment to flatten the surface of the filter layers 3. Consequently, the difference in level of the intra-surface film thickness is confined within $0.5\mu\text{m}$. Transparent electrodes (ITO) are sputtered directly on the color filters after the stages described above. In such a case, the film deposition condition of the transparent electrodes is good.

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LAYER TRANSPARENT SUBSTRATE

ADDL-INDEXING-TERMS:
SUPER TWISTED NEMATIC

DERWENT-CLASS: P81 U14 V05

EPI-CODES: U14-K01A1C;

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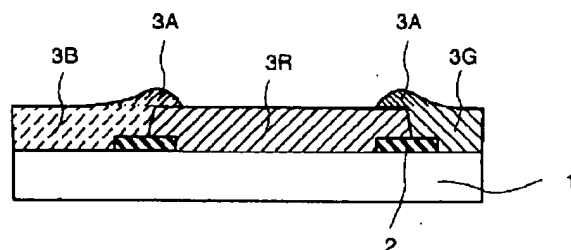
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(54) 【発明の名称】 カラーフィルタ

(57) 【要約】

【課題】 細い線幅の遮光部の存在する画素パターンをもったカラーフィルタを製造する際の位置合わせの問題、および透明電極を膜付けした際の断線不良の問題を解決する。

【解決手段】 フィルタ層のパターニングの際、隣接する画素の周辺部同士が、線幅8 μ m以下の遮光層上で重なるようにパターニングされ、該重なり部の盛り上がりが研磨により除去され、面内膜厚段差0.5 μ m以下に平坦化されたことを特徴とするカラーフィルタ。



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【特許請求の範囲】

【請求項1】透明基板上に形成されたパターン状の遮光層と、該遮光層が施されていない開口部に複数色のフィルタ層が順次パターン形成されてなるカラーフィルタにおいて、隣接するフィルタ層の周辺部同士が遮光層上で重なるようにパターンニングされ、かつ重なり部の盛り上がりが研磨により平坦化されたことを特徴とするカラーフィルタ。

【請求項2】遮光層の線幅が $8\mu\text{m}$ 以下である請求項1記載のカラーフィルタ。

【請求項3】面内膜厚段差が $0.5\mu\text{m}$ 以内である請求項1または2記載のカラーフィルタ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、カラー液晶表示装置やプラズマディスプレイパネル等に用いられるカラーフィルタ、とりわけ高精細なパターンをもつカラーフィルタに関する。

【0002】

【従来の技術】カラー液晶表示装置においてカラー表示を行うために、光透過部に開口部のあるパターンを形成した遮光層（ブラックマトリクス）の上に赤、緑、青のフィルタ層をパターン形成したカラーフィルタが一般的に用いられている。最近の液晶表示装置に関する市場の要求として、画面輝度の向上のためにそのカラーフィルタの開口率を向上させること、および液晶表示装置を用いた製品の高付加価値化のために画素を高精細化することが求められている。しかしそれらの要求を実現しようとする段階で、カラーフィルタを製造する工程における画素パターンの位置合わせ精度が大きな問題となってくる。

【0003】従来技術によれば、図1に示すように、パターン状の遮光層2（ブラックマトリクス）の線幅aが細かい場合、画素の位置ずれは遮光部線幅aの半分（ $a/2$ ）以下でなければならず、製造装置の位置精度の限界から、遮光部線幅aが $8\mu\text{m}$ 未満の品種については製造することが困難であった。

【0004】上記図1の例は、フィルタ層3がストライプ状の細長く連続したパターンの場合であったが、フィルタ層3が図4（a）または図4（b）に示すようなデルタ配列の場合、上記の問題に加え、以下のような不具合があった。すなわち、図5に示すように、（a）のストライプ画素のフィルタ層3sに比べ（b）のデルタ配列のドット画素3dは、画素が島状で単位面積当たりの画素周囲の長さが長いので、パターン形成時の現像およびエッチングのスピードが速くなり、断面が図6（a）に示すような逆テーパ形状となる可能性が高く、図6（b）に示すように透明電極4（ITO）膜付をした際に断線不良を起こす危険性が高くなっていた。

【0005】

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【発明が解決しようとする課題】本発明は、細い線幅の遮光部の存在する画素パターンをもったカラーフィルタを製造する際の上記のような問題点を解決することを目的とする。

【0006】

【課題を解決するための手段】本発明は、透明基板上に形成されたパターン状の遮光層と、該遮光層が施されていない開口部に複数色のフィルタ層が順次パターン形成されてなるカラーフィルタにおいて、隣接するフィルタ層の周辺部同士が遮光層上で重なるようにパターンニングされ、かつ重なり部の盛り上がりが研磨により平坦化されたことを特徴とするカラーフィルタであり、さらに言えば、本発明は上記の製造工程により得られる遮光層の線幅が $8\mu\text{m}$ 以下のカラーフィルタに適用され、また、好ましくは本発明は上記の製造工程により得られる面内膜厚段差を $0.5\mu\text{m}$ 以内としたカラーフィルタである。

【0007】

【発明の実施の形態】本発明の実施の形態を以下に図面を用いて説明する。まず、図2および図7に示すように基板1上に遮光層であるブラックマトリクス2をフォトリソグラフィ等によりパターン形成した後、第1色目のフィルタ層3Rをパターン形成する。次いでフィルタ層3Gを、その画素端がフィルタ層3Rの画素端が重なるようにパターンニングする。同様にフィルタ層3Bもパターンニングする。

【0008】この工程について、デルタ配列のパターンの場合を例に説明すると、図9に示すように画素ピッチをX方向x、Y方向y、Cr線幅（最狭部）をaとすると、画素の重ね合わせ寸法bは、有効画素部（ブラックマトリクスパターンの開口部）への隣接画素のフィルタ層の侵入、すなわち混色や、有効画素部でのパターン不着、すなわち白抜けが起こらない条件を考えると、 $0\mu\text{m}$ 以上、 $a\mu\text{m}$ 以下で設計することができる。これを、X方向： $b_1\mu\text{m}$ 、Y方向： $b_2\mu\text{m}$ とすると、1画素の設計寸法は、X方向が $(x+2b_1)\mu\text{m}$ 、Y方向が $(y+2b_2)\mu\text{m}$ となる。そして、パターン露光の際のアライメントずれ許容値は、図10からもわかるように、X方向については b_1 もしくは $a-b_1$ のうちの小さい値、Y方向については b_2 もしくは $a-b_2$ のうちの小さい値となる。この結果、形成可能な最狭のCr線幅は、約 $4\mu\text{m}$ まで可能となる。

【0009】この後、重ね合せ部3Aを、研磨処理により図3および図8に示すように研磨除去し、フィルタ層3表面を平坦化する。その結果、面内膜厚段差を $0.5\mu\text{m}$ 以内とすることができる。以上の工程の後、場合により該カラーフィルタ表面に直接、透明電極（ITO）をスパッタリングする場合があるが、その場合、透明電極の着膜状況は良好であり、従来発生していたような、パターンニングされたレジストの断面の端部形状が逆

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テーパー状になり、その部分で透明電極が断線する状況は見られない。

【0010】

【発明の効果】本発明の方法により、必要な位置精度が実質的に緩和され、遮光部線幅が $8\mu\text{m}$ 以下の微細なパターンを有するカラーフィルタであっても容易に作成可能となった。また、デルタ配列のカラーフィルタにおいては、オーバーコートなどの工程を増やさずに面内膜厚段差の極めて小さい、平坦なカラーフィルタが得られる。そのため、従来の方法で作成したカラーフィルタにITO膜付をした際に起こしていた断線不良が生じる恐れがなくなった。さらに、STN方式の液晶表示装置においては、表面段差の許容範囲が $0.5\mu\text{m}$ 以下と極めて小さいが、本発明では表面段差の大きい場合に生じやすいチルトリパース（液晶の配向不良）等が生じなくなり、表示品質が向上するという効果がある。

【0011】

【図面の簡単な説明】

【図1】従来のカラーフィルタの一例を示す断面図である。

【図2】本発明のカラーフィルタの製造途中を示す説明図である。

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【図3】本発明のカラーフィルタの一実施例を示す説明図である。

【図4】(a)～(b)は、デルタ配列の画素の一例を示す説明図である。

【図5】(a)～(b)は、サイドエッチングの状況を模式的に示す説明図である。

【図6】(a)～(b)は、逆テーパー形状のパターン断面をもったカラーフィルタの様子を示す説明図である。

【図7】本発明のカラーフィルタの製造途中を示す説明図である。

【図8】本発明のカラーフィルタの一実施例を示す説明図である。

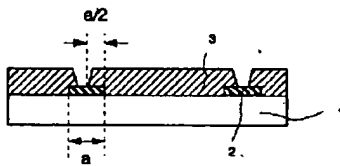
【図9】カラーフィルタの設計寸法を示す説明図である。

【図10】カラーフィルタの設計寸法を示す説明図である。

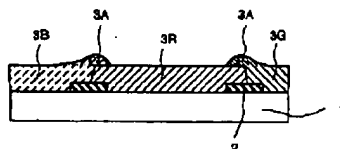
【符号の説明】

- | | |
|---|-------|
| 1 | 透明基板 |
| 2 | 遮光層 |
| 3 | フィルタ層 |
| 4 | 透明電極 |

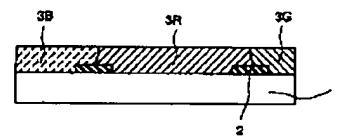
【図1】



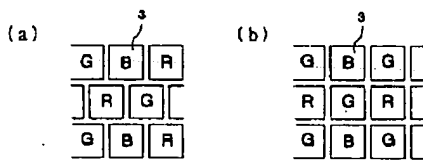
【図2】



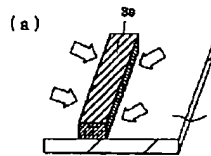
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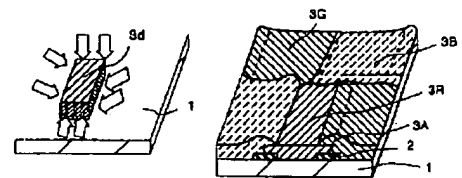
【図4】



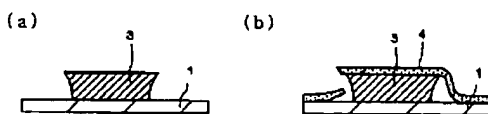
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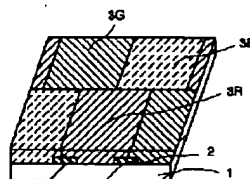
【図7】



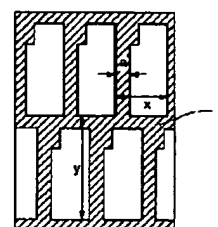
【図6】



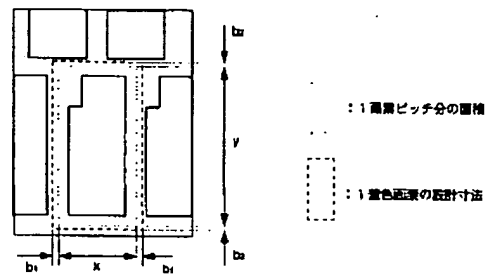
【図8】



【図9】



【図10】



PATENT ABSTRACTS OF JAPAN

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(72)Inventor : EDA KOURAI

INOUE FUTOSHI

OKAMOTO TAKASHI

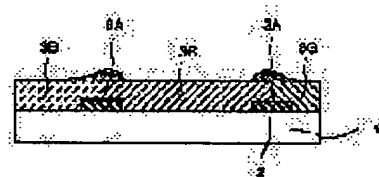
(54) COLOR FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To relieve positional accuracy and to make it possible to form color filters having fine patterns by patterning the peripheral parts of adjacent filter layers so as to overlap these parts on each other with light shielding layers and flattening the build-ups of the overlap parts by polishing.

SOLUTION: Black matrices 2 which are the light shielding layers are pattern formed on a substrate 1 and, thereafter, the filter layer 3R of the first color is pattern formed. Next, the filter layer 3G is patterned in such a manner that the pixel ends thereof overlap on the pixel ends of the filter layer 3R. Similarly, the filter layer 3B is patterned as well. The overlap parts 3A are thereafter removed by the polishing treatment to flatten the surface

of the filter layers 3. Consequently, the difference in level of the intra-surface film thickness is confined within $0.5\mu\text{m}$. Transparent electrodes (ITO) are sputtered directly on the color filters after the stages described above. In such a case, the film deposition condition of the transparent electrodes is good.



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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The color filter characterized by having carried out patterning so that the peripheries of the protection-from-light layer of the shape of a pattern formed on the transparence substrate and the filter layer which adjoins in the color filter with which it comes to carry out pattern formation of the filter layer of two or more colors to opening to which this protection-from-light layer is not given one by one might lap on a protection-from-light layer, and flattening of the climax of the lap section being carried out by polish.

[Claim 2] The color filter according to claim 1 whose line breadth of a protection-from-light layer is 8 micrometers or less.

[Claim 3] The color filter according to claim 1 or 2 whose field intima heavy filling bar difference is less than 0.5 micrometers.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the color filter used for a color liquid crystal display, a plasma display panel, etc., and a color filter with an especially high definition pattern.

[0002]

[Description of the Prior Art] In order to perform color display in a color liquid crystal display, generally the color filter which carried out pattern formation of red, green, and the blue filter layer is used on the protection-from-light layer (black matrix) in which the pattern which has opening in the light transmission section was formed. Making a pixel highly minute for the tendency to heighten the added value of the product using raising the numerical aperture of the color filter as a demand of the commercial scene about the latest liquid crystal display for improvement in screen intensity and a liquid crystal display is called for. However, in the phase where it realizes those demands, the alignment precision of the pixel pattern in the process which manufactures a color filter poses a big problem.

[0003] According to the conventional technique, as shown in drawing 1, the location gap whose line breadth a of the pattern-like protection-from-light layer 2 (black matrix) is a pixel when thin had to be below one half ($a/2$) of the protection-from-light section line breadth a , and was difficult for the protection-from-light section line breadth a to manufacture about a less than 8-micrometer form from the limitation of the location precision of a manufacturing installation.

[0004] Although the example of above-mentioned drawing 1 was the case where the filter layer 3 was the pattern which the shape of a stripe is long and slender, and continued, in the delta array as the filter layer 3 shows to drawing 4 (a) or drawing 4 (b), in addition to the above-mentioned problem, it had the following faults. As shown in drawing 5, it compares with 3s of filter layers of the stripe pixel of (a). Namely, 3d of dot pixels of the delta array of (b) By the shape of an island, since the die length of the perimeter of a pixel per unit area is long, the development at the time of pattern formation and the speed of etching become [a pixel] quick. Possibility of becoming an inverse tapered shape configuration as a cross section shows to drawing 6 (a) was high, and as shown in drawing 6 (b), when it carried out with transparent electrode 4 (ITO) film, the danger of causing a poor open circuit was high.

[0005]

[Problem(s) to be Solved by the Invention] This invention aims at solving the above troubles at the time of manufacturing a color filter with the pixel pattern with which the protection-from-light section of thin line breadth exists.

[0006]

[Means for Solving the Problem] In the color filter with which it comes to carry out pattern formation of the filter layer of two or more colors to opening to which the protection-from-light layer and this protection-from-light layer of the shape of a pattern by which this invention was formed on the transparence substrate are not given one by one If it is the color filter by which it is characterized and says further that patterning was carried out so that the peripheries of the adjoining filter layer might lap on a protection-from-light layer, and flattening of the climax of the lap section was carried out by polish

It is the color filter with which the line breadth of the protection-from-light layer obtained by the production process of the above [this invention] set to less than 0.5 micrometers the field intima heavy filling bar difference which is applied to a color filter 8 micrometers or less, and is acquired by the desirable production process above-mentioned [this invention].

[0007]

[Embodiment of the Invention] A drawing is used for below and the gestalt of operation of this invention is explained to it. First, as shown in drawing 2 and drawing 7, after carrying out pattern formation of the black matrix 2 which is a protection-from-light layer with photolithography etc. on a substrate 1, pattern formation of the filter layer 3R of the 1st amorous glance is carried out. Subsequently, the pixel edge carries out patterning of filter layer 3G so that the pixel edge of filter layer 3R may lap. Patterning also of the filter layer 3B is carried out similarly.

[0008] If a pixel pitch is set into the direction x of X, and the direction y of Y and Cr line breadth (narrowest part) is set to a as it is shown in drawing 9, when the case of the pattern of a delta array is explained to an example about this process Even if the superposition dimension b of a pixel considers invasion of the filter layer of the contiguity pixel to the effective pixel section (opening of a black matrix pattern), i.e., color mixture, and the conditions from which the pattern miscarriage in the effective pixel section, i.e., a white omission, does not happen, it can be designed by 0 micrometers or more and below amum. It is this Direction:bof X 1 mum, the direction of Y: b2 If mum, as for the design dimension of 1 pixel, $\mu(x+2b1)$ m and the direction of Y will be set to $\mu(y+2b2)$ m by the direction of X. And the alignment gap allowed value in the case of pattern exposure is b1 about the direction of X so that drawing 10 may also show. Or a-b1 About an inner small value and the direction of Y, it is b2. Or a-b2 It becomes an inner small value. Consequently, Cr line breadth of the maximum ** which can be formed becomes possible to about 4 micrometers.

[0009] Then, by polish processing, as shown in drawing 3 and drawing 8, polish removal of the superposition section 3A is carried out, and flattening of the filter layer 3 front face is carried out. Consequently, a field intima heavy filling bar difference can be set to less than 0.5 micrometers. After the above process, although sputtering of the transparent electrode (ITO) may be directly carried out to this color filter front face by the case, in that case, the film deposition situation of a transparent electrode is good, the end shape of the cross section of a resist which had been generated conventionally and by which patterning was carried out becomes inverse tapered shape-like, and the situation which a transparent electrode disconnects in the part is not seen.

[0010]

[Effect of the Invention] By the approach of this invention, a required location precision was eased substantially, and even if protection-from-light section line breadth was the color filter which has a detailed pattern 8 micrometers or less, creation became possible easily. Moreover, in the color filter of a delta array, the very small flat color filter of a field intima heavy filling bar difference is obtained, without increasing the process of an overcoat etc. Therefore, a possibility that the poor open circuit caused when it was made the color filter created by the conventional approach with the ITO film might arise disappeared. Furthermore, in the liquid crystal display of a STN method, although the tolerance of a surface level difference is very as small as 0.5 micrometers or less, by this invention, the tilt reverse (the poor orientation of liquid crystal) which is easy to produce when a surface level difference is large stops arising, and it is effective in display quality improving.

[0011]

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing an example of the conventional color filter.

[Drawing 2] It is the explanatory view showing the manufacture middle of the color filter of this invention.

[Drawing 3] It is the explanatory view showing one example of the color filter of this invention.

[Drawing 4] (a) - (b) is the explanatory view showing an example of the pixel of a delta array.

[Drawing 5] (a) - (b) is the explanatory view showing the situation of side etching typically.

[Drawing 6] (a) - (b) is the explanatory view showing the appearance of a color filter with the pattern cross section of an inverse tapered shape configuration.

[Drawing 7] It is the explanatory view showing the manufacture middle of the color filter of this invention.

[Drawing 8] It is the explanatory view showing one example of the color filter of this invention.

[Drawing 9] It is the explanatory view showing the design dimension of a color filter.

[Drawing 10] It is the explanatory view showing the design dimension of a color filter.

[Description of Notations]

1 Transparence Substrate

2 Protection-from-Light Layer

3 Filter Layer

4 Transparent Electrode

[Translation done.]